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Western Europe: Implications of Energy Import Dependence

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An Intelligence Assessment

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An Intelligence Assessment

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Western Europe: Implications of Energy Import Dependence

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Key Judgments

Information available as of 17 May 1983 was used in this report.

Our analysis of recent industry forecasts indicates that Western Europe will continue to rely on imports for 40 to 50 percent of total energy supplies through the end of the century. Imports will account for three-fourths of total oil demand throughout the period. One-third of 1990 gas needs are expected to be met by imports, and these could rise to as much as 50 percent of total requirements at the end of the century. As a result, Western Europe will remain vulnerable to energy supply disruptions, especially if the energy market begins to tighten in the early 1990s as most of these forecasts project. Should oil prices continue to remain weak over the next few years or decline further, several gas projects might be postponed or delayed. Such developments would enhance the Soviet Union's ability to increase gas sales in the 1990s unless West European purchasers were willing to make a political commitment to subsidize high-cost indigenous projects to encourage timely development of gas supplies.

Almost all forecasts predict that West European oil consumption will hold fairly steady or decline over the balance of the century. Oil's share of total energy is expected to decline as well. By the end of the century, however, oil is still expected to account for 35 to 45 percent of total West European energy needs. As a result, West European countries belonging to the Organization for Economic Cooperation and Development (OECD) will remain heavily dependent on the Persian Gulf as a source of oil.

Despite the prospects for a soft energy market over the next few years, all recent forecasts expect substantial increases in West European gas use in every major country except the United Kingdom. Domestic production is expected to decline or remain flat at best, indicating that West European dependence on imports will rise substantially. By 1990, Western Europe is expected to rely on the Soviet Union for 20 percent of total gas requirements, with West Germany, France, and Italy relying on Moscow for 30 percent or more. Unless steps are taken soon to increase indigenous gas production or to contract for supplies from other non-OECD sources, Western Europe's dependence on Soviet gas could be even higher by the turn of the century.

Continued weak demand has already forced a drop in oil prices, and further declines are a distinct possibility. The improved competitiveness of oil resulting from a price decline would initially dampen nonoil energy demand, increase West European dependence on imported oil supplies, and

lead to the delay or cancellation of several high-cost projects aimed at increasing Western Europe's indigenous energy production. Because of long leadtimes required to bring gas reserves on stream, no new North Sea gas supplies would be available if energy demand recovered in the early 1990s, as most of these forecasts now expect. Such developments would enhance the Soviet Union's ability to capture a greater share of the West European gas market, given Moscow's willingness to price competitively because of its hard currency needs and ability to step up deliveries relatively quickly.

A tighter market in the early 1990s would increase Western Europe's vulnerability to an energy supply disruption. Although the odds are against a major internal or external disruption in energy supplies in any particular exporting nation or region, the probability that some sort of disruption would occur is quite high. Since a large portion of oil and gas supplies will be imported from non-OECD sources, the risks associated with a disruption, especially from the Middle East, will remain high. While West European gas importers probably have enough flexibility to offset a simultaneous six-month disruption in Soviet and Algerian gas supplies in 1990 through fuel switching, stock drawdowns, and surge production, some price pressures are likely to develop. A simultaneous cutoff of Middle East oil supplies and Soviet gas would entail extremely high economic and political costs for Western Europe.

Because of their high import dependence, West European countries probably will remain reluctant to actively support certain US positions in negotiations with energy producers. Concern over energy security is also likely to cause several governments to intervene in the marketplace and impose artificial restraints such as export controls whenever a disruption or the threat of a loss of supplies occurs.

In addition to measures already in place, West European countries have several other available options which—if undertaken in the near term—would help lessen the potential dangers of energy supply disruptions in the 1990s. They are:

- To the extent possible, diversifying oil supplies away from the volatile Middle East region.
- Undertaking a political commitment to guarantee the development of indigenous gas reserves in the North Sea.
- Paying a premium to the Netherlands to extend gas contracts in the early 1990s in exchange for an equal volume of Norwegian gas later in the decade.
- Having European gas importers pay a premium to the Netherlands to maintain strategic gas reserves to be used in the event of a disruption.

Contents

Table 1
Energy Projections [a]

Million b/doe

	1980	1990	2000
Western Europe			
Energy consumption	25.5	27.7-28.4	30.8-34.2
Net imports	12.9	11-12.7	13.9-17.4
Oil consumption	13.5	10.7-12.8	8.4-13.4
Oil production	2.4	2.7-3.3	2.4-2.9
Net imports	11.2	7.9-9.8	6-11
Natural gas consumption	3.6	3.9-4.5	4.6-5.1
Natural gas production	3.2	2.9-3.3	2.5-3.3
Net imports	0.5	0.8-1.5	1.3-2.5
Coal consumption	5.6	6-7.8	7.1-11.3
Coal production	4.5	4.4-4.6	4.4-5.2
Net imports	1.2	1.8-3.2	4-6.1
Hydro and nuclear	2.8	5.3-5.9	6.6-8.0
United Kingdom			
Energy consumption	4.1	4.1-4.4	4.3-5
Net imports (exports)	0.2	(0.1)-(0.5)	
Oil consumption	1.7	1.4-1.6	1.3-1.7
Oil production	1.6	1.4-2.1	
Net imports (exports)	NEGL	(0.4)-(0.5)	
Natural gas consumption	0.8	0.9-1.0	0.9-1.1
Natural gas production	0.6	0.7-0.8	
Net imports	0.2	0.1-0.2	
Coal consumption	1.4	1.4-1.7	1.5-1.7
Coal production	1.5	1.5-1.7	
Net imports (exports)	NEGL	NEGL	
Hydro and nuclear	0.2	0.3-0.4	0.3-0.6
France			
Energy consumption	4	4.4-4.9	4.8-5.6
Net imports	3		
Oil consumption	2.3	1.7-2.2	1.8-2.4
Oil production	NEGL	NEGL	
Net imports	2.3	1.7-2.0	
Natural gas consumption	0.4	0.5-0.7	0.5-0.8
Natural gas production	0.1	0.1	
Net imports	0.3	0.4-0.6	
Coal consumption	0.7	0.3-0.8	0.5-0.9
Coal production	0.3	0.2-0.3	
Net imports	0.4	0.1-0.5	
Hydro and nuclear	0.6	1.3-1.8	1.5-2.4
Italy			
Energy consumption	2.9	3.2-3.6	3.7-5.1
Net imports	2.4	2.7-3.1	
Oil consumption	2.0	1.5-2	1.6-2.3
Oil production	NEGL	NEGL	
Net imports	1.9	1.5-2	
Natural gas consumption	0.5	0.6-0.7	0.8
Natural gas production	0.2	0.1-0.2	
Net imports	0.2	0.4-0.5	
Coal consumption	0.3	0.5-0.7	0.8-1.4
Coal production	NEGL	NEGL	
Net imports	0.2	0.7	
Hydro and nuclear	0.2	0.3-0.4	0.5-0.6
West Germany			
Energy consumption	5.5	5.4-6	5.7-6.8
Net imports	3.1	3-3.2	
Oil consumption	2.7	2-2.6	1.9-2.7
Oil production	0.1	0.1	
Net imports	2.7	1.9-2.5	
Natural gas consumption	0.9	0.8-1.1	0.9-1.1
Natural gas production	0.3	0.2-0.3	
Net imports	0.6	0.6-0.8	
Coal consumption	1.7	1.7-2.1	2
Coal production	1.8	1.8	
Net imports (exports)	(0.1)	0.1-0.3	
Hydro and nuclear	0.3	0.5-0.7	0.8-1.0

[a] Numbers may not add to totals shown due to rounding.

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Western Europe: Implications of Energy Import Dependence

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Energy Market Outlook

The success of long-term forecasts for the world energy market has been minimal. Because of uncertainties regarding economic performance, price trends, and consumer response to higher prices, most forecasts have substantially overestimated energy demand in recent years and understated the energy savings from conservation and technological change. Recent long-term forecasts remain vulnerable to the shortcomings of past projections because most of the results are based on assumptions about highly uncertain variables such as economic growth, energy prices, and the degree of response of supply and demand to changes in prices.

We examined an array of forecasts completed in the past five months to assess long-term energy requirements in Western Europe through 2000. Our survey includes recent long-term energy market projections by major oil companies, governments, and consulting firms (see the appendix: tables A-1 through A-14). Most forecasters expect soft market conditions to continue through most of the 1980s, with gradually rising oil demand beginning to tighten the oil and energy markets around 1990. Under these conditions, surplus production capacity will be sufficient to handle a moderate oil supply interruption through most of the 1980s. As the oil supply cushion erodes around the end of the decade, however, Western Europe will become increasingly vulnerable to supply disruptions.

Demand Forecasts

Recent forecasts continue to reflect downward revisions of energy requirements, indicating only moderate demand growth in Western Europe through the end of the century. The decline in energy consumption in recent years is expected to bottom out this year, and West European energy consumption is projected to rise at an average annual rate of 1.0 percent during this decade, to about 28 million barrels per day oil equivalent (b/doe) by 1990. During the remainder of the century, forecasts call for European energy consumption to grow at an average annual rate of 1.7 to 2.5 percent, with total energy consumption for 2000 ranging from 31-34 million b/doe. Most of the increase in West European energy demand through the end of the century is expected to be met by nonoil fuels (table 1).

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Oil

Oil consumption in Western Europe is expected to hold fairly steady or to decline through 1990. Forecasts of West European oil consumption in 1990 range from 11-13 million barrels per day (b/d). Although oil's share of total energy is projected to decline during the decade, oil will continue to account for about 40 to 45 percent of total energy requirements by 1990. West European oil use in 2000 is projected to range from 8-13 million b/d, still some 35 to 45 percent of energy requirements.

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Increased oil use in the transportation sector is expected to be offset by lower oil use in most other sectors. Oil use in the electricity-generation sector is expected to fall from more than 1.6 million b/d in 1980 to less than 1 million b/d by 2000 (figures 4 and 5). Despite a projected decline in oil use, the residential/commercial and industrial sectors still will rely on oil for about one-third and one-seventh percent, respectively, of energy requirements by 2000.

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Forecasters expect West European oil production to range from 2.4-2.9 million b/d in 2000 compared to actual production of 2.4 million b/d in 1980. During the period, British oil production is expected to peak at 2.5 million b/d in 1985 before declining to 1.4-2.1 million b/d in 1990 and 1.5-1.7 million b/d in 2000.

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Current Requirements at a Glance

Despite lower energy use and increased production of oil and nuclear power, Western Europe relied on imported energy for more than 40 percent of its requirements last year. Preliminary country data indicate that West European primary energy consumption excluding electricity generated by oil and gas fell to about 24 million barrels per day of oil equivalent (b/doe) in 1982, about 5 percent below year-earlier levels. Nuclear power output rose while use of other fuels held steady or declined. A 4-percent decline in oil consumption pushed oil's share of total energy down to less than 50 percent. Natural gas use also dropped—for the third consecutive year—to about 3 million b/doe, or some 10 percent below peak 1979 levels.

OECD and individual country data indicate that West Germany, France, Italy, and the United Kingdom account for about two-thirds of total West European energy demand. The United Kingdom, West Germany, the Netherlands, and Norway combined account for roughly 70 percent of total European energy production (table 2):

- *Oil accounts for about half of total West European energy requirements, varying from 40 percent of total energy use in the United Kingdom to 70 percent in Italy.*
- *Natural gas accounts for about 15 percent of European energy use. West Germany, the United Kingdom, and the Netherlands combined account for almost two-thirds of West European gas consumption. Domestic gas production, mostly from the United Kingdom, Norway, and the Netherlands, supplied Europe with almost 90 percent of gas requirements in 1980.*
- *Coal consumption amounted to about 6 million b/doe in 1980, or about 20 percent of overall energy use.*
- *Nuclear and hydropower combined supply about 11 percent of energy requirements.*

West European countries as a group relied on net imported energy—mostly oil—for about 13 million b/doe or about half of total energy requirements in 1980:

- *Net oil imports of about 11 million b/d amounted to 80 percent of oil requirements and about 45 percent of energy consumption. Reliance on supplies from the Persian Gulf region alone amounted to about 7 million b/d, or more than 50 percent of oil imports (figure 1).*
- *Natural gas imports from the USSR and Algeria accounted for about 15 percent of European gas use in 1980 (figure 2).*
- *Coal imports in 1980 amounted to about 1 million b/doe, or 20 percent of consumption. About half of coal imports came from OECD countries (figure 3).*

Reliance on imported energy among individual West European countries varied widely. Italy, France, and West Germany imported 80, 75, and 55 percent of total energy requirements in 1980, respectively. At the other extreme, the United Kingdom, the Netherlands, and Norway remained almost self-sufficient in net energy trade.

The industrial and residential/commercial sectors each accounted for about a fourth of total energy demand in Western Europe, according to OECD data. Oil and natural gas combined supply 55 percent of industrial energy needs and about two-thirds of requirements in the residential and commercial sectors, excluding electricity generated by oil and gas (figure 4). The transportation sector consumed mostly oil and accounted for about 16 percent of total energy use. Fuel used in generating electricity accounted for the remaining 30 percent of European energy consumption with coal and hydropower accounting for almost two-thirds of fuel inputs. Oil and natural gas combined supplied only about 25 percent of power plant consumption (figure 5).

Table 2
Western Europe: Energy Requirements, 1980 [a]

Million b/doe

	Western Europe	West Germany	France	Italy	United Kingdom	Nether-lands	Norway
Energy consumption	25.5	5.5	4.0	2.9	4.1	1.5	0.5
Energy production	13.0	2.5	1.1	0.5	4.0	1.5	1.2
Energy imports	18.7	3.7	3.3	2.7	1.4	1.7	0.2
Net energy imports (exports)	12.9	3.1	3.0	2.4	0.2	0.1	(0.7)
Oil consumption	13.5	2.7	2.3	2.0	1.7	0.8	0.2
Domestic oil production	2.4	0.1	NEGL	NEGL	1.6	NEGL	0.5
Oil imports	12.2	2.8	2.5	2.2	1.1	1.6	NEGL
Persian Gulf	6.9	0.8	1.6	0.9	0.7	0.7	NEGL
Other OPEC countries	2.6	0.7	0.4	0.5	0.1	0.3	NEGL
Total OPEC	9.6	1.6	2.0	1.5	0.7	0.9	NEGL
USSR	1.1	0.1	0.2	0.1	NEGL	0.1	NEGL
Other non-OECD countries	1.2	0.2	0.1	0.4	0.2	0.1	NEGL
OECD	0.1	0.9	0.3	0.1	0.3	0.4	0.1
Oil exports	0.9	0.1	0.3	0.2	1.1	0.8	0.5
Net oil imports (exports)	11.22	2.7	2.3	1.9	NEGL	0.8	(0.3)
Natural gas consumption	3.6	0.9	0.4	0.5	0.8	0.6	NEGL
Domestic gas production	3.2	0.3	0.1	0.2	0.6	1.4	0.5
Gas imports	0.5	0.8	0.3	0.2	0.2	0.1	0
Algeria	0.1	0	NEGL	0	0	0	0
Libya	0	0	0	0	0	0	0
USSR	0.4	0.2	0.1	0.1	0	0	0
Other non-OECD countries	NEGL	0	0	0	0	0	0
OECD		0.6	0.3	0.1	0.2	0.1	0
Netherlands		0.4	0.2	0.1	0	0	0
Norway		0.2	NEGL	0	0.2	0.1	0
Total gas exports	0	0.2	NEGL	0	0	0.8	0.5
Net gas imports (exports)	0.5	0.6	0.3	0.2	0.2	(0.8)	(0.5)
Coal consumption	5.6	1.7	0.7	0.3	1.4	0.1	NEGL
Domestic coal production	4.5	1.8	0.3	NEGL	1.5	0	NEGL
Coal imports	1.2	0.2	0.5	0.3	0.1	0.1	NEGL
South Africa	0.3	NEGL	0.1	NEGL	NEGL	NEGL	0
Poland	0.3	NEGL	NEGL	NEGL	NEGL	NEGL	0
USSR	0.1	NEGL	NEGL	NEGL	NEGL	0	0
Other non-OECD countries	0.1	NEGL	0.2	0.1	NEGL	NEGL	0
OECD	0.6	0.1	0.2	0.1	0.1	0.1	NEGL
United States	0.5	NEGL	0.1	0.1	NEGL	NEGL	0
Australia	0.1	NEGL	NEGL	NEGL	NEGL	NEGL	0
Exports		0.3	NEGL	NEGL	0.1	NEGL	NEGL
Net imports (exports)	1.2	(0.1)	0.4	0.2	NEGL	0.1	NEGL
Hydro	1.8	0.1	0.3	0.2	NEGL	0	0.3
Nuclear	1.0	0.2	0.3	NEGL	0.2	NEGL	0

[a] Numbers may not add to totals shown due to rounding. Most recent year for which complete data is available.

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Figure 1
Oil Imports by Source, 1980

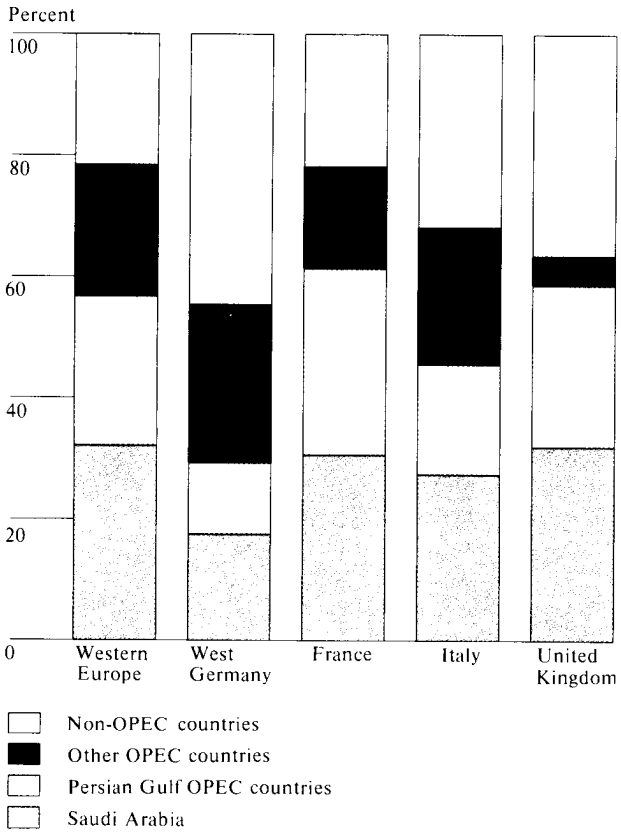

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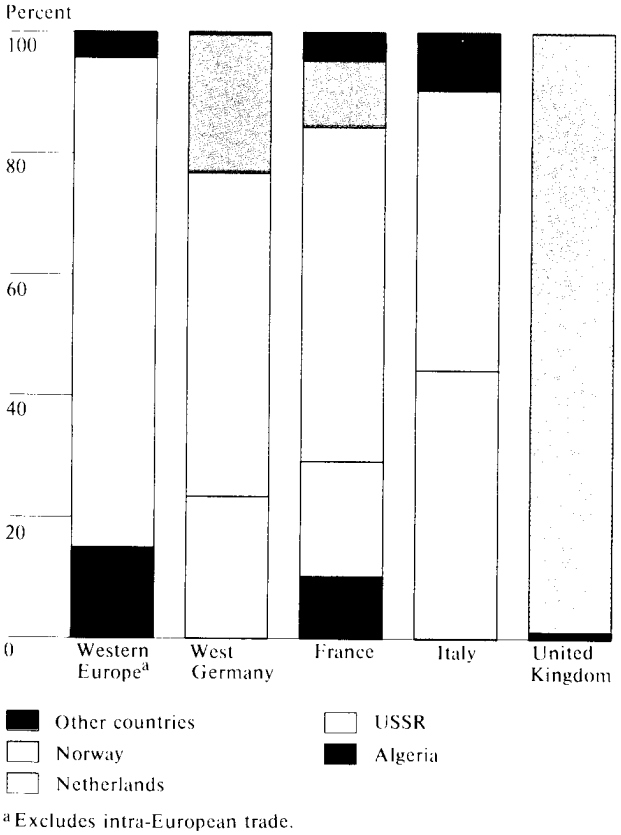
Figure 2
Natural Gas Imports by Source, 1980



[a] Excludes intra-European trade.

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Figure 3
Coal Imports by Source, 1980

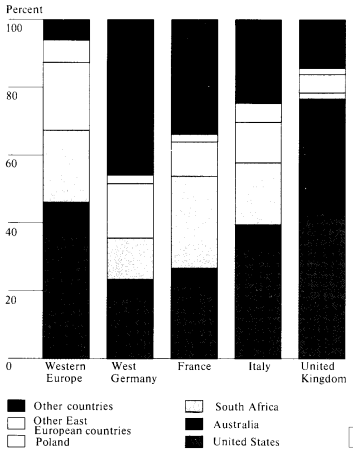


Figure 4
Energy Consumption by Sector, 1980

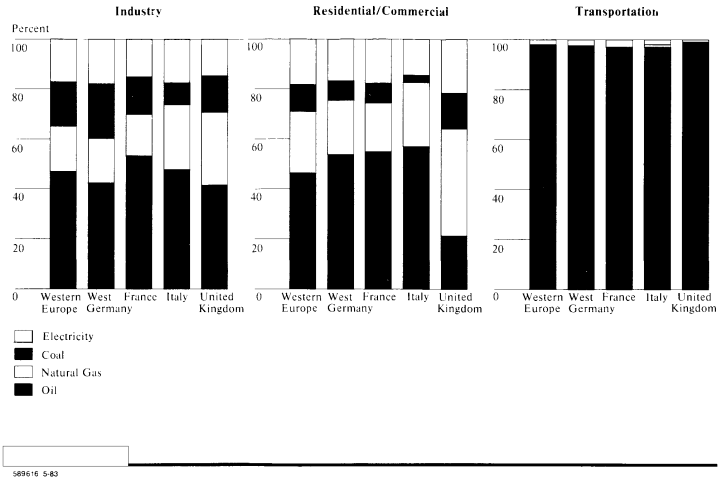
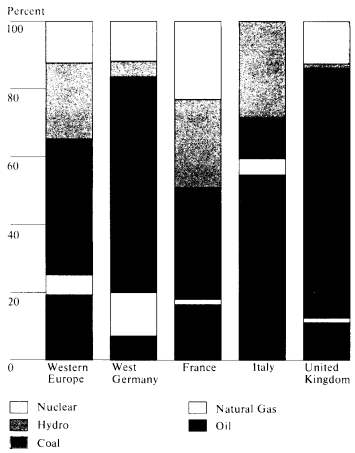


Figure 5
Electricity Generation, 1980



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Natural Gas

Given the soft oil market outlook and an expected escalation in the price of gas relative to other fuels, most government and industry analysts have revised downward long-term projections of West European gas consumption. Forecasts now project the region's gas demand to rise from 3.6 million b/doe in 1980 to about 3.9-4.5 million b/doe in 1990. Natural gas use is expected to continue to grow during the 1990s and range from 4.6-5.1 million b/d by 2000. All major countries except the United Kingdom are expected to register substantial increases in gas use. West Germany, Italy, and France combined are expected to account for over half of all West European gas consumption in both 1990 and 2000.

Most of the growth in West European gas demand probably will occur in the residential/commercial sector. One major firm expects this sector to account for half of European gas demand in 1990 and 2000, while the West German gas association forecasts that the number of households hooked up to gas will rise from 5.4 million in 1980 to 9 million by 1990. Data Resources, Inc. (DRI) projects that the share of gas in the residential/commercial sector will rise from about a fourth to about a third by 2000 and that oil and gas combined will supply about two-thirds of energy requirements in this sector. Increased use of gas in the industrial sector will be limited, however, by price competition with residual fuel oil. Power plant usage of natural gas is expected to continue to fall in absolute terms as higher gas prices relative to competing fuels—particularly nuclear power and coal—make it difficult for power companies to expand gas use.

West European gas production is expected to approximate 2.9-3.3 million b/doe by 1990, and to range from 2.5-3.3 million b/doe by 2000. Dutch output is expected to fall from 1.4 million b/doe in 1980 to about 1 million b/doe in 1990 and 500,000 b/doe in 2000. These lower production estimates reflect current Dutch policy banning new gas export contracts. It is possible, however, that the recent slump in domestic gas sales, and future government revenue requirements could lead to some relaxation of the ban on new export sales. Norway, with its huge North Sea reserves, will have the ability to increase gas production sharply in the 1990s. Recent projections put Norwegian production as high as 640,000 b/doe in 1990 and 860,000 b/doe in 2000. These estimates assume, however, that continental buyers will be willing to pay some premium for Norwegian gas in order to diversify their sources of supply. 25X1

Coal, Nuclear, and Hydro

Forecasts of West European coal consumption in 1990 range from 6-8 million b/doe. Projections for coal use in 2000 range from 7-11 million b/doe. Nuclear and hydro production combined are expected to double during this decade to 5.3-5.9 million b/doe. On the basis of expectations of expanded nuclear plant construction, we expect consumption of these fuel sources to reach 6.6-8.0 million b/doe by 2000. 25X1

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Implications for Energy Trade

Despite substantial progress in reducing energy needs through conservation and substitution since the early 1970s, industry projections point to continued high West European dependence on imported energy supplies, especially oil and natural gas, through the end of the century. During the period, most forecasts expect Western Europe to depend on imported energy for 40 to 50 percent of total energy requirements. Reliance on imported energy in individual West European countries will vary widely. The United Kingdom, Norway, and the Netherlands will remain basically self-sufficient in net energy trade. In contrast, dependence on imported energy in West Germany and France is expected to approximate 50 to 60 percent, and reliance on imports in Italy is projected to exceed 80 percent through 2000. 25X1 25X1

Oil

West European reliance on imported oil is expected to fall to 8-10 million b/d in 1990 and to 6-11 million b/d by 2000. On the basis of the midrange estimate, it appears that imported oil as a percent of energy requirements will fall to roughly 30 percent in 1990 and about 25 percent in 2000. The major West European countries will remain heavily dependent on imported oil:

- France is expected to depend on imported oil for 34 to 45 percent of total energy requirements through the end of the century.

Key Assumptions

Assumptions about overall economic growth and prices are critical to long-term energy market projections. Even small changes in variables can cause substantial modifications in projected energy requirements. We have examined the key assumptions of recent industry forecasts and, in our view, they appear reasonable (table 3).

Prices

Most of the energy supply/demand projections assume declining real oil prices to 1985, flat real prices from 1985 to 1990, and real price increases of 1.5 to 3 percent per year through 2000. Although most forecasters agree on the general trend of crude oil prices, they point out that the price path may not be a smooth one. Forecasters believe that oil prices are more likely to rise as a result of a supply disruption than of continued growth in oil consumption.

The continuing soft oil market has led many forecasters to scale back price assumptions from year-earlier levels. Last year, for example, the consensus forecast of the 1990 benchmark oil price ranged from $34 to $40 per barrel in constant 1981 dollars. In current projections, the benchmark OPEC oil price expressed in 1981 dollars is expected to range from $24 to $29 per barrel in 1985 and from $26 to $31 per barrel in 1981 dollars for 1990. Price assumptions for 2000 are in the range of $31 to $40 per barrel in constant 1981 dollars. 25X1

Assumptions about other energy prices are generally less precise. Indeed, most forecasts do not explicitly treat the potential for interfuel substitution, citing only assumptions about relative price levels and in some cases indicating where potential supply constraints may exist. In general, prices of other fuels are expected to move in line with oil prices. 25X1

Growth

The forecasts assume average annual real economic growth of 1.8 to 2.5 percent during the 1980s for Western Europe. Given economic performance since 1980 and expectations for 1983, GNP in Western Europe would have to average about 3 percent annually through 1990 to achieve a 2.1-percent annual growth rate for the decade. Forecasts point to an average annual growth rate of 2.4 to 2.8 percent during the 1990s. Yearly variations in growth due to the effects of the business cycle are not accounted for in these forecasts. Variability above and below the average growth for the period can account for sizable swings in energy consumption. 25X1

- West German dependence is expected to trend downward but remain at about 30 to 40 percent of total energy.
- Net oil imports as a share of total energy in Italy are expected to be roughly 50 to 55 percent in 1990 and 35 to 40 percent in 2000.

Future oil import patterns are difficult to predict. Flows will depend in part on political developments and contractual arrangements. Although no estimates are available for sources of imports for 1990 and beyond, most forecasters indicate that OPEC will retain its position as the principal supplier of internationally traded oil. Most long-term forecasts indicate that demand for OPEC oil will approximate 25-30 million b/d, or roughly half of non-Communist oil supplies between 1990 and 2000. Because Persian Gulf OPEC countries account for nearly 60 percent of non-Communist oil reserves, Western Europe's reliance on this region will remain substantial. 25X1

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Natural Gas

Recent forecasts project West European gas import needs as low as 800,000 b/doe and as high as 1.5 million b/doe in 1990. On the basis of the midpoint estimate of natural gas consumption and indigenous production in these forecasts, we estimate that the region's natural gas import demand will approximate

Table 3
Key Assumptions of Forecasts

	West European Economic Growth *(average annual percent change)*		Oil Price *(OPEC benchmark 1981 $ per barrel)*	
	1980-90	1990-2000	1990	2000
Data Resources	2.1	2.6	30.87	40.49
Firm A	NA	NA	NA	NA
Firm B	1.8	2.3	28.24	37.95
Firm C	2.0	2.6	26.32	35.35
Firm D	2.5	2.5	NA	NA
Firm E	NA	NA	26.55	30.81
Firm F	2.3	2.8	NA	NA
OECD Requirement Study	2.1	2.7	27.60	37.10

[redacted]

1.4 million b/doe in 1990, or about a third of anticipated total gas requirements (tables 4 through 9):

- The USSR is expected to supply about 800,000 to 900,000 b/doe, or about 20 percent of total gas requirements. France, West Germany, and Italy will be the major importers of Soviet gas. France and Germany have already signed contracts for additional supplies of gas from the USSR that could push dependence on Soviet gas above 30 percent of requirements. Italy is also expected to contract for an additional 100,000 to 130,000 b/doe, bringing Italian reliance on Soviet gas to about 36 percent by 1990.

- On the basis of current contracts, it appears that Algeria will supply Europe with 400,000 to 460,000 b/doe of natural gas in 1990—about 10 percent of total requirements. Most of this gas will go to France and Italy.

- Libya is expected to export about 60,000 b/doe of liquefied natural gas (LNG) to Italy and Spain in 1990. [redacted]

Table 4
Western Europe: Natural Gas Supply and Demand [a]

Billion cubic meters

	1980 [b]	1990 Midrange Estimate	2000 Midrange Estimate
Demand	218	258	297
Production	194	171	134
Netherlands [c]	85	57	32
Norway [c]	29	29	17
United Kingdom	39	47	49
Other European countries	41	38	36
Import demand	32	87	163
Non-OECD contracted supplies	32	78-86	78-86
Soviet [d]		49-55	49-55
Existing	26		
Urengoi		26	26
Minimum		24	24
Maximum		30	30
Libya		4	4
Algeria [e]			
Minimum	5	25	25
Maximum		27	27
Other	1		
Supply gap		1	77
Potential supplies			
Algeria			28-35
Norway [f]		4	50-60
Netherlands		19	17
LNG			23
USSR [g]		10-15	10-15

[a] Numbers may not add to totals shown due to conversion and rounding.
[b] 1980 data is actual trade. Discrepancy between supply and consumption is due to stocks and losses in transformation.
[c] Export contracts plus domestic consumption. Netherlands consumption assumed at 30 mtoe in 1990 and 20 mtoe in 2000.
[d] Soviet contract estimates include Italy.
[e] Algerian contract estimates do not include Spain, as contracts are being renegotiated.
[f] Norway potential includes Sleipner, Troll, and several other small fields.
[g] USSR supply potential is for existing export capacity only.

[redacted]

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Table 5
West Germany: Natural Gas Supply and Demand [a]

Billion cubic meters

	1980 [b]	1990 Midrange Estimate	2000 Midrange Estimate
Demand	59	60	61
Production	18	17	15
Import demand	46	43	46
Contracted supplies	46	45-48	30-33
Soviet	11	20-23	20-23
Existing	11	12	12
Urengoi			
Minimum		8	8
Maximum		11	11
Libya			
Algeria			
Minimum			
Maximum			
Netherlands	24	15	
Norway	11	10	10
Supply shortfall (surplus)		(2-5)	13-16

[a] Numbers may not add to totals shown due to rounding.
[b] Actual trade.

Table 6
France: Natural Gas Supply and Demand [a]

Billion cubic meters

	1980 [b]	1990 Midrange Estimate	2000 Midrange Estimate
Demand	28	36	39
Production	8	4	4
Import demand	21	32	35
Contracted supplies	21	24-26	24-26
Soviet		11-13	11-13
Existing	4	4	4
Urengoi			
Minimum		6	6
Maximum		9	9
Libya			
Algeria	2	9	9
Minimum			
Maximum			
Netherlands	12		
Norway	2	4	4
Supply shortfall		6-8	6-8

[a] Numbers may not add to totals due to rounding.
[b] Actual trade.

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Although we believe contracted supplies should be ample to meet projected demand in Western Europe through 1990, the situation varies across individual countries:

- Italy probably will cover import needs through 1990 if it signs to take additional Soviet gas.
- France has supply contracts to cover 80 percent of gas import requirements but will need to get an additional 120,000 b/doe to meet projected demand. Paris may be able to rely on Dutch contract flexibility to meet at least part of this shortfall.
- On the basis of current estimates of gas demand in 1990, West Germany could have surplus gas supplies of 20,000 to 40,000 b/doe. German utilities probably will eliminate this surplus by exercising their option to reduce purchases of Siberian gas by 20 percent. A decision by the utilities on this matter has been deferred until October 1983.
- Belgium has firm supply contracts for about half of expected requirements and is seeking additional Dutch gas to meet part of the projected 80,000- to-120,000-b/doe shortfall by 1990.

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France, Belgium, and Italy could realize a shortfall in contracted supplies from Algeria because of production problems in Algeria's largest gasfield. We estimate that on average Algeria will meet only about half of its annual gas export commitments in the late 1980s and early 1990s. If demand materializes as expected, such a shortfall probably would encourage additional European purchases of Soviet gas late in the decade or force higher levels of domestic production.

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Table 7
Italy: Natural Gas Supply and Demand [a]

Billion cubic meters

	1980 [b]	1990 Midrange Estimate	2000 Midrange Estimate
Demand	27	39	49
Production	12	7	7
Import demand	15	32	42
Contracted supplies	15	33-35	27-29
Soviet		13-15	13-15
Existing	7	7	7
Urengoi			
Minimum		6	6
Maximum		8	8
Libya	1	2	2
Algeria		12	12
Minimum			
Maximum			
Netherlands	7	6	
Norway			
Supply shortfall (surplus)		(1-3)	13-15

[a] Numbers may not add to totals shown due to rounding.
[b] Actual trade.

[redacted]

1990s. If the midrange demand estimate of 4.9 million b/doe in 2000 proves accurate, we believe Western Europe will need to contract for additional gas supplies for the 1990s. On the basis of existing contracts and estimates of indigenous production, total gas availability in Western Europe will approximate 3.5-3.6 million b/doe:

- The USSR will supply 800,000 to 900,000 b/doe of gas to Europe through 2000.
- Algeria will export 420,000 to 460,000 b/doe of natural gas annually to Europe through the end of the century.
- Libya is committed to export about 60,000 b/doe to Western Europe until 2000.
- Norway has contracted to supply about 280,000 b/doe of natural gas to Germany, France, Belgium, and the Netherlands until 2000.
- The Netherlands's export contracts expire before 1995; the Dutch are expected to produce only 520,000 b/doe in 2000 to meet domestic requirements.

Table 8
United Kingdom: Natural Gas Supply and Demand [a]

Billion cubic meters

	1980 [b]	1990 Midrange Estimate	2000 Midrange Estimate
Demand	50	55	59
Production	39	48	51
Import demand	11	7	8
Contracted supplies	11	12	
Norway	10	12	
Algeria	1		
Supply shortfall (surplus)		(4)	8

[a] Numbers may not add to totals shown due to rounding.
[b] Actual trade.

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Table 9
Belgium: Natural Gas Supply and Demand [a]

Billion cubic meters

	1980 [b]	1990 Midrange Estimate	2000 Midrange Estimate
Demand	11	12	13
Production			
Import demand	11	12	13
Contracted supplies	12	5-8	5-8
Soviet			
Existing			
Urengoi			
Minimum			
Maximum			
Netherlands	10		3
Norway	3	3	3
Algeria			
Minimum		3	3
Maximum		5	5
Supply shortfall (surplus)		4-7	5-8

[a] Numbers may not add to totals shown due to rounding.
[b] Actual trade.

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- Other West European production—mainly from the United Kingdom—is expected to approximate 1.4 million b/doe.

Given demand estimates from recent forecasts, Western Europe will need to contract for an additional 1.3-1.4 million b/doe for the 1990s to balance gas needs. Unless gas demand is sharply below anticipated levels and/or future gas export availability from North Sea producers is higher than currently projected, West European countries will have a difficult time holding dependence on a single supplier to no more than 30 percent of requirements.

Potential Suppliers. Several gas producers are in an excellent position to supply any incremental gas to the West European market in the 1990s, because of their substantial gas reserves. Norway, Canada, Iran, Nigeria, Algeria, and the Soviet Union have all viewed the European market as a potential outlet for new gas sales. Except for Moscow and Algiers, however, decisions must be taken soon to ensure deliveries by the early 1990s.

Norway. The Norwegian Government, which has traditionally pursued a go-slow attitude toward offshore petroleum development, has recently underscored its willingness to make substantial volumes of gas available to Western Europe in the 1990s. Norway has two major natural gasfields available for development in the 1990s, the Sleipner field and the Troll field, and sufficient gas reserves to support expanded production after 2000. Sleipner and Troll combined contain natural gas reserves of over 12 billion barrels oil equivalent (boe). Sleipner could potentially produce 330,000 b/doe by 1995, and production from Troll could approximate 660,000 b/doe by 2000. Gas from neither of these fields is currently contracted for, however, and new large North Sea projects of this type are likely to be quite costly compared to supplies available from other sources.

developing the Troll field could cost well in excess of $15 billion and that, even with an average production rate of 200,000 b/doe, unit costs will be significantly higher than those of more conventional projects.

the cost of producing gas from Troll could be as high as $3.40 to $4.25 per million Btu.

A further complication as to potential Norwegian gas supplies available to Western Europe is the fact that the continental and UK gas markets are physically separate and compete for Norwegian gas. Although a decision has not yet been made, there is a good possibility that Sleipner gas will be landed in the United Kingdom, leaving only Troll gas as an additional Norwegian source available to the continent in this century. State Department reporting indicates that the current thinking in Oslo is to move forward quickly with negotiations for the sale of Troll gas—probably in 1984—without waiting for completion of exploratory drilling on neighboring blocks. 25X1

Algeria. Despite near-term problems with gas production and exports, we believe that the declining production of oil and natural gas liquids in the 1990s will force Algeria to seek expanded markets for natural gas.[1] Although committed to exports of only about 460,000 b/doe in 2000, Algeria's gas reserves could permit an additional 460,000 to 580,000 b/doe of natural gas exports by the end of the century. Any expansion in gas exports will require sizable investments in numerous new production wells and gas pipelines.

Libya and Other Potential LNG Suppliers. Although committed to supplying about 60,000 b/doe of gas to Western Europe through 2000, Libya could potentially export an additional 180,000 b/doe by either increasing LNG export facilities or constructing a pipeline to Europe. As much as 200,000 b/doe of LNG could also be available from a variety of other suppliers, including Cameroon, Nigeria, Qatar, and possibly Canada. Most of these projects are still being studied, however, and we believe that the likelihood of several of these projects appears increasingly doubtful because of the weak energy market.

USSR. Vast natural gas reserves in West Siberia indicate that total potential natural gas supplies from the USSR to Western Europe are probably limited only by European demand for Soviet gas. By minimizing hard currency outlays and accepting relatively low returns on domestic resources, the Soviet Union is

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capable of delivering gas to Western Europe at prices that are competitive with all other fuels. Moreover, to ensure hard currency earnings, we believe the Soviets will continue to price their gas at levels that guarantee West European market penetration. The apparent readiness of the USSR to agree to more flexible delivery patterns also enhances the competitive strength of Soviet gas in the European market. Because of surplus capacity in the existing export pipeline system, the Soviet Union already has the capability of delivering at least 160,000 to 240,000 b/doe of additional gas to Western Europe and continues to seek new markets for gas.

Netherlands. Currently Europe's largest gas supplier, the Netherlands is the most reliable and economical source of additional gas. Under current government policies designed to conserve gas resources, Dutch gas for exports will dwindle to zero by 2000. Contract flexibility and Dutch revenue needs could alter this situation:

- Gas deliveries under existing contracts—due to be phased out in the early 1990s—probably can be stretched through at least the mid-1990s by deferring gas deliveries from earlier years when available supplies exceed demand. Both France and Italy, for example, have recently cut back Dutch imports to conserve these reserves for strategic purposes.

- Given the size of Dutch gas reserves—about 12.6 billion boe—and the budgetary pressures confronting The Hague, a new gas policy is being formulated, and we believe new export contracts might be authorized. According to Dutch officials, however, any additional exports probably will be at a premium price.

In the absence of a change in current government export policy, the Netherlands could still act as a potential offset in the event of a supply disruption. We believe the Dutch, however, would be likely to demand compensation to hold strategic reserves for other countries.

Coal

Rising consumption combined with fairly flat domestic production is expected to increase West European dependence on imported coal to 4-6 million b/doe by 2000—about 15 percent of total energy requirements. Coal trade within the region is expected to decline gradually with the bulk of the increase in imports projected to come from other OECD countries, primarily the United States and Australia. Other sources of supply are likely to be South Africa and new coal-exporting countries like Colombia. West European imports of coal from Poland and the Soviet Union could increase by a small amount. 25X1

Impact of Lower Oil Prices

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Continued weak demand has already forced a drop in oil prices, and a further decline remains a distinct possibility. Should this occur, future energy supply and demand patterns could be considerably different from current projections. The improved competitiveness of oil initially would dampen nonoil energy demand relative to oil, and increase West European dependence on imported oil supplies. 25X1

Even if lower energy prices eventually resulted in greater economic growth and increased energy consumption, as expected, they would also reduce the amount of new energy projected to come from high-cost indigenous production. In particular, lower oil prices could lead to the delay of major new North Sea projects such as the Norwegian Troll field, because low returns would make these large capital investment projects uneconomic. At crude oil prices of $25 per barrel and below, for example, residual fuel oil prices would approximate $3.60 per million Btu or less, 25X1 while new gas deliveries from Norway would cost about $5 per million Btu. Investments in some high-cost North Sea oil projects would be similarly affected. 25X1

Using CIA's linked econometric model, we estimate that a fall in the price of crude oil to $25 per barrel—15 percent below our base case—would lead to an increase in energy demand of 1 million b/doe in Western Europe by 1990. Because nearly all the increase is in the demand for oil, gas demand remains 25X1 virtually unchanged. Unless gas producers were confident of a substantial rebound in energy prices, or gas development projects were subsidized, Norwegian and other projects probably would be postponed.

25X1

Because of the long leadtimes required to bring gas reserves on stream, no new North Sea gas supplies would be available if energy demand recovered in the early 1990s. Such developments would enhance the Soviet Union's ability to capture a greater share of the West European gas market, given the Soviets' surplus capacity in existing pipelines and considerable flexibility in directing gas from domestic pipelines. We believe that Moscow's need for hard currency earnings would ensure that its gas would be priced competitively with other fuels to guarantee access to the European market. When market conditions did tighten again, however, the Soviets could be expected to raise prices to maximize revenues.

Policies To Increase Energy Security

Since 1973, West European governments have recognized the need to reduce reliance on imported energy, particularly oil. Most countries have encouraged conservation, substitution, increased indigenous production, and diversification of import sources, although policy emphasis among the major governments has varied. West Germany has relied on the free market to spur conservation. France has pushed conservation and development of nuclear power, and the United Kingdom has emphasized development of indigenous supplies.

Oil

Most West European governments have concentrated on measures to reduce dependence on imported oil and have instituted compulsory oil stock regulations to cope with supply disruptions. The EC Commission, for example, requires each member country to maintain onshore stocks of oil products equivalent to 90 days of 1982 inland oil consumption. In the United Kingdom and France, the oil industry has to meet virtually the entire compulsory stock requirement. Public companies have been established in West Germany and the Netherlands to hold part of compulsory stocks. On the basis of industry analysis, we estimate that compulsory stocks in excess of minimum operating levels in Western Europe are equal to roughly 300-400 million barrels. The West Germans also have established a government-owned stockpile containing about 55 million barrels. Some other measures governments have considered or implemented include:

- Relaxation of oil price controls—in part to assure a fair supply of oil during an emergency.
- Contingency plans to allocate or ration petroleum products during major disruptions.
- Use of the International Energy Agency and EC sharing plan.

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Natural Gas

In response to the large and increasing share of gas imports in total gas consumption, some European countries have also begun to implement policies designed to minimize the impact of an interruption in supplies. These measures include diversification of sources, conservation of indigenous gas resources, increased storage of natural gas, increasing the number of interruptible contracts, and reliance on the Netherlands for increased supplies during an emergency:

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- In West Germany, most new industrial gas customers are now offered only interruptible contracts. Recent estimates indicate that from 20 to 25 percent of German industry has the capability to switch from natural gas to alternative fuels—primarily oil. In the event of a supply disruption, gas utilities would require customers with dual-fired capability to switch to alternate sources of energy. We estimate that this could amount to roughly 120,000 b/doe by 1990.

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- Current French Government plans call for doubling storage capacity to 66 million boe by 1990, about half of which will be used to store gas to meet peak winter requirements. Gaz de France intends to increase the amount it sells under interruptible contracts from 15 percent of current sales to 20 percent in 1990, or about 100,000 b/doe.

- Italy plans to increase gas imports in this decade and shut in about 80,000 to 100,000 b/doe of domestic production for use in an emergency. Storage capacity is expected to approach 47 million boe in 1990, but about half of this is committed to meet seasonal needs.

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Risks of Disruptions

Although the odds are against a major internal or external disruption in energy supplies in any particular exporting nation or region, the probability that some sort of disruption will occur is quite high—particularly for oil and natural gas. Since 1950, for example, oil supplies from major exporting countries have been interrupted on 14 occasions. Since a large proportion of the oil used by Western Europe will continue to be imported, the risks associated with a disruption will remain high.

Increased dependence on natural gas imports from a few countries also raises the potential cost of a gas supply disruption. Western Europe will be importing substantial volumes of natural gas from three potentially insecure sources, the USSR, Algeria, and Libya. Natural gas is less flexible than oil because transmission systems are fixed and supplies are limited. While the international community has limited experience in dealing with gas disruptions, Soviet gas supplies have been disrupted on several occasions during the peak winter demand period because of technical problems and Moscow's pressing needs for domestic consumption. In the event of a future cutoff, consumers are unlikely to know, at least initially, either the size or duration of a disruption, and these uncertainties could lead to severe pressures to take actions.

Specific conditions prevailing at the onset of an oil or gas supply disruption—such as the level of commercial and strategic stocks, position in the business cycle, the level of international cooperation and political leadership abilities—can also have an important impact on the nature of the market reaction. Perceptions regarding the uncertainties that probably will surround most disruptions, along with the specific environment in which the disruption takes place, have the potential to turn even seemingly minor problems into major crises.

Oil Disruptions

On the basis of our survey of recent market forecasts, the gradual erosion of excess productive capacity later in this decade will leave the oil market increasingly vulnerable to supply cutoffs around 1990 and beyond. The oil industry believes 2-3 million b/d of surplus capacity is needed to keep the oil market stable. Although stocks will play a role in mitigating impacts, the cushion of surplus commercial stocks is likely to be far below current levels by 1990. In addition, consuming countries have shown a reluctance to draw down compulsory or strategic stocks during an interruption. Even so, the potential for a drawdown in these stocks could have a dampening effect on prices. We have examined three possible oil disruption scenarios for 1990, each lasting six months and under forecasted market conditions:

- *Case I:* A loss of 13 million b/d in productive capacity. For example, a supply cutoff from the Middle East. 25X1
- *Case II:* A loss of 5 million b/d in capacity associated with an event such as a major war in the Persian Gulf area.
- *Case III:* A loss of 2 million b/d in capacity in a single country or in several countries for technical or political reasons. 25X1

Economic Impact. The oil supply disruptions in 1973 and 1979 had major economic impacts. Oil prices rose sharply, and in the months following the disruption there were noticeable increases in inflation, slowdowns in economic growth, and rises in unemployment. The precise economic impacts of future supply disruptions are difficult to gauge because of structural changes that have occurred in the relationship between energy use and economic growth and the 25X1
inability to estimate psychological impacts such as consumer stockbuilding behavior. We have attempted to measure the order of magnitude of economic impacts from a supply disruption using the CIA's linked econometric model. On the basis of the mid-range of projected supply/demand levels for 1990, a net oil shortfall was calculated for each of the three hypothetical disruptions. The CIA model was then used to measure the impact on prices, GNP, and energy demand. Simulations for the first-year effect on Western Europe compared against a base case (no disruption) showed that: 25X1

- *Case I.* GNP loss amounts to 3.8 percentage points and oil prices rise 52 percent above the basecase level.

- *Case II.* GNP is reduced by 1.4 percentage points and oil prices rise 18 percent above the basecase level.
- *Case III.* GNP is reduced by 0.6 percentage point and oil prices rise 7 percent above the basecase level.

Gas Supply Disruptions

On the basis of expected levels of gas consumption and imports, it appears that growing dependence on imported gas in the late 1980s could pose problems for Western Europe. A disruption in gas supplies from the Soviet Union or from the Soviet Union and Algeria would sharply reduce gas availability if measures are not taken to limit vulnerability. The Soviets might be inclined to disrupt gas supplies to Western Europe:

- To pressure West European governments to adopt policies more favorable to the Soviet Union.
- To countervail economic sanctions, including a grain embargo.

By 1990, gas supplies from Algeria and the Soviet Union could supply one-third of overall gas demand in Western Europe, and a much higher percentage in France and Italy. A gas supply disruption in Europe, therefore, is potentially quite serious, particularly in the event that suppliers act in concert.

The seasonal nature of gas requirements would tend to magnify the potential impact if a disruption occurred in the winter. West European winter gas consumption in 1981, for example, averaged about 720 million cubic meters per day, while summer requirements declined to about 360 million cubic meters per day. Because most of the growth in gas use is expected in the residential sector, fluctuation in seasonal demand is likely to be even more pronounced in the future.

West German imports of gas from the Soviet Union are contracted to be as much as 340,000 to 360,000 b/doe or about 36 percent of projected gas supplies in 1990. French imports could be 180,000 to 200,000 b/doe, or about 32 percent of gas needs, and Italy will probably rely on Soviet supplies for 180,000 to 200,000 b/doe, or 36 percent of requirements. The Soviet Union and Algeria together could be providing more than half of total Italian gas supplies and almost 60 percent of French requirements by 2000. Although a combined Soviet-Algerian disruption is unlikely, we believe joint action cannot be ruled out. In a more likely case, a major interruption from one supplier would result in higher prices but continued supplies from the unaffected country. 25X1

We have examined a gas supply disruption taking place over the winter and lasting six months. To assess the impact, we estimated the following possible supply offsets to determine the vulnerability of the key individual countries: 25X1

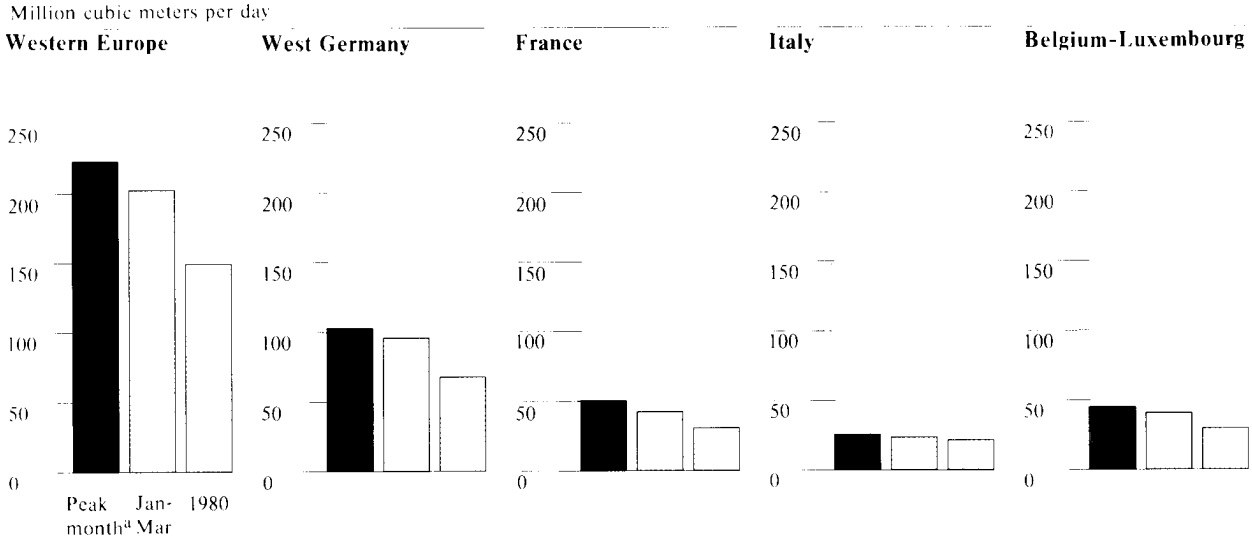
- The level of potential surge capacity from excess indigenous production.
- The volume of gas available from cutting off interruptible contracts.
- Surge capacity from the Netherlands.
- Stock draws from gas storage. 25X1

The amount of supply offsets were estimated on the basis of government plans and/or industry projections. In the case of additional supplies from the Netherlands, we have assumed that export capacity is approximately equal to deliveries during the winter of 1979-80, when Dutch production and exports peaked at 223 million cubic meters per day (figure 6). 25X1

Our analysis indicates that Italy would have a more difficult time than France and West Germany in coping with a loss in Soviet and Algerian gas supplies in 1990. Italy's flexibility is limited mainly by the lack of opportunity to increase Dutch imports during a disruption. Italian imports of Dutch gas are already scheduled to approximate peak levels in 1990. Even France and West Germany would require a cutback in supplies to some customers and sharp inventory drawdowns. Both would also have to rely on incremental Dutch production to offset interrupted supplies. Because precise engineering data on the gas transmission system are not available, it is uncertain whether sufficient capacity exists to deliver the extra volumes of Dutch gas to all affected customers. 25X1 25X1

France could have problems drawing on Dutch supplies because of physical limitations in the grid. 25X1 25X1

Figure 6
Gas Flows From the Netherlands, 1980



[a] The peak month is January for all countries except France, the peak month for which is November 1979.

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A total cutoff of Soviet gas in the winter could amount to about 150 million cubic meters per day, about a sixth of anticipated winter demand in 1990. Possible estimated supply offsets (table 10) include:

- Increased indigenous production of 49 million cubic meters per day mainly from West Germany and Italy.
- An additional 150 million cubic meters per day of surge production from the Netherlands.
- Cutting off customers with interruptible contracts that could equal about 80 million cubic meters per day.
- Drawdown of surplus inventories of 52 million cubic meters per day, mainly from Italy and France.

On balance the available offsets appear adequate to balance a Soviet gas disruption in 1990. This does not preclude, however, some upward pressure on energy prices. Fuel switching could apply upward pressure to oil prices, and—because of the linkage between oil and gas prices—the latter could increase as well. Energy prices in and of themselves might be bid up because of the uncertainties regarding the length of a disruption.

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Simultaneous Oil and Natural Gas Disruptions

A simultaneous energy supply disruption involving oil and natural gas would pose serious problems for Western Europe, particularly in the 1990s. We have examined two possible scenarios:

- A cutoff of Middle East oil and Soviet gas supplies.
- A cutoff of oil supplies from Saudi Arabia and Soviet supplies.

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The impact of either disruption on Western Europe in 1990 would be severe. In the first scenario, Western Europe would be deprived of about 15 percent of total energy supplies in 1990, and in the second scenario total West European energy supplies would be reduced by about 10 percent. Our linked econometric model indicates that oil prices would rise by 53 percent and the GNP loss in Western Europe would amount to 3.9 percentage points under the first case. Under the second case, prices would rise 46 percent

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Table 10
Western Europe: Daily Gas Flows in Peak Winter Months, 1990 [a]

Million cubic meters per day

	Western Europe	West Germany	France	Italy
Supply/demand balance	950	205	130	138
Soviet gas	150	63	34	40
Algerian gas	76		27	33
Netherlands	201	50		22
Other supplies	423	78	31	33
Seasonal stock-draw	100	14	38	10
Disrupted supplies				
Soviet disruption	150	63	34	40
Soviet plus Algerian	226	63	60	73
Estimated possible offsets	331	99	96	62
Increased indigenous [b]	49	22		27 [b]
Production (excludes Netherlands)				
Netherlands supplies [c]	150	52	50	3
Shedding interruptible contracts	80	25	16	10
Stockdraw	52		30	22

[a] Based on current contractual commitments.
[b] Assume capacity equal to peak production (December 1978 for Italy and February 1979 for West Germany).
[c] Capacity based on expected Dutch demand plus peak export levels achieved during January 1980.

and GNP would fall by 2.5 percentage points. These results, however, understate the impact because the model is able to capture the impact of lost gas supplies only to the extent that gas users can convert to oil.

A dual-fuel supply disruption, particularly in the winter, would eliminate most of Western Europe's contingency plans for coping with a supply cutoff, since the bulk of fuel switching capability in industry is between oil and gas. In addition to a likely sharp runup in energy prices, availability would be severely limited, especially in the residential sector. According to one study, oil and gas combined will supply about two-thirds of energy consumption in the residential sector in Western Europe by 1990 and 75 percent by 2000 (figures 7 through 10). Residential sector dependence could approach 80 percent for Italy.

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Geopolitics of Dependence

High dependence on imported energy, particularly oil and natural gas, will leave West European countries susceptible to political pressures from within as well as outside their national borders. As demonstrated during previous major supply disruptions, West European countries tend to respond to intense domestic pressures by active market intervention to secure adequate oil supplies through government-to-government deals, restrictions on oil trade, and stepped-up spot purchases. As energy markets tighten, the amount of political leverage oil exporters can exert during either a minor or major supply disruption will increase. Increased West European dependence on non-OECD natural gas supplies will leave European countries increasingly vulnerable to political pressures from countries like the Soviet Union and Algeria.

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Future Policy Options

Measures already taken probably will reduce the role of oil in total energy consumption, but Europe will continue to rely heavily on oil imports from the Middle East. Although probably little can be done about substantially increasing indigenous oil production, European countries can to the extent possible diversify supplies away from the Middle East. European countries will have to import increasing amounts of natural gas over the balance of the century. Unless indigenous supplies are developed in the Netherlands and Norway, European dependence on Soviet and Algerian gas supplies could exceed 50 percent by 2000:

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- Given the high cost of developing Norwegian gasfields and the present weak market, we believe it is extremely doubtful that projects would be undertaken on economic considerations alone. Indeed, present market conditions will require a political commitment by Europeans to ensure timely development.

- The Netherlands could play a key role in minimizing non-OECD gas imports in the early-to-mid-1990s if they are willing to extend export contracts. West European purchasers probably will have to show their willingness to maintain Dutch supplies by paying higher prices.

- The Dutch might also be persuaded to sell more gas with a commitment from Norway to replace these supplies in later years. Such an arrangement would have to prove commercially attractive to the Dutch, however, before it would be attempted.

- The Dutch could also add to European energy security in the late 1990s and beyond by maintaining strategic gas reserves. Commitments between individual countries and the Netherlands will need to be clearly defined, however, and the Netherlands probably will demand a premium price to maintain this capacity.

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Figure 7
Energy Consumption by Sector, 1990

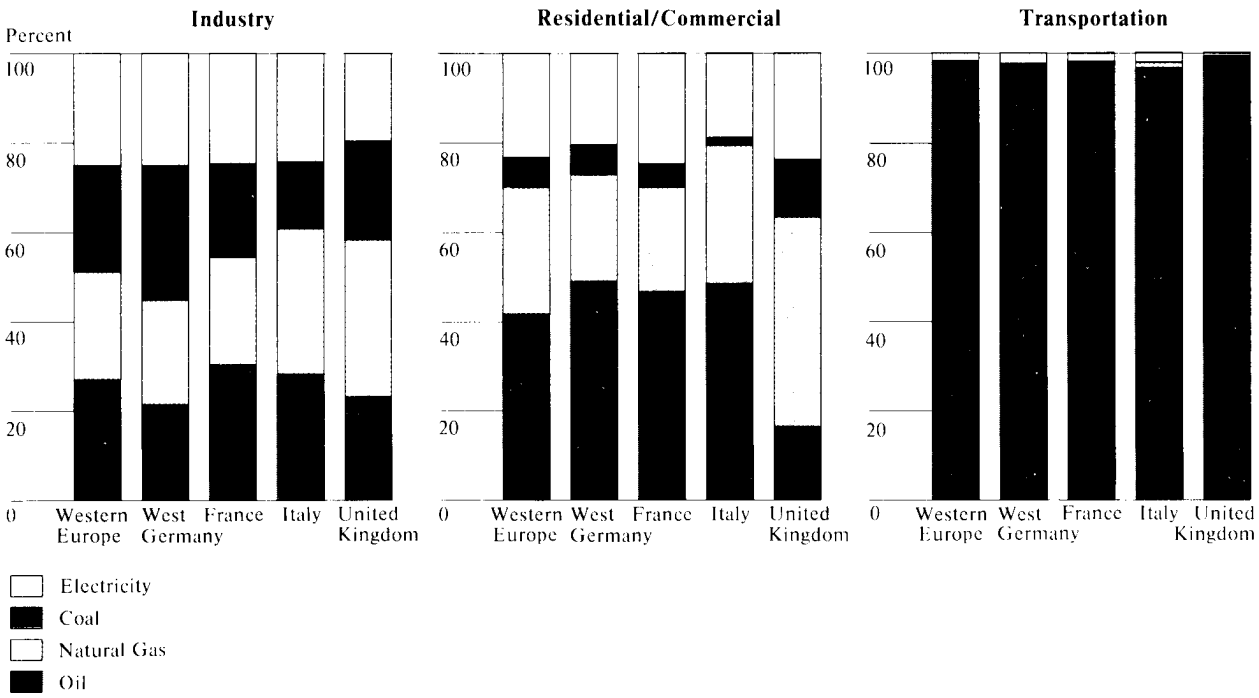

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Figure 8
Energy Consumption by Sector, 2000

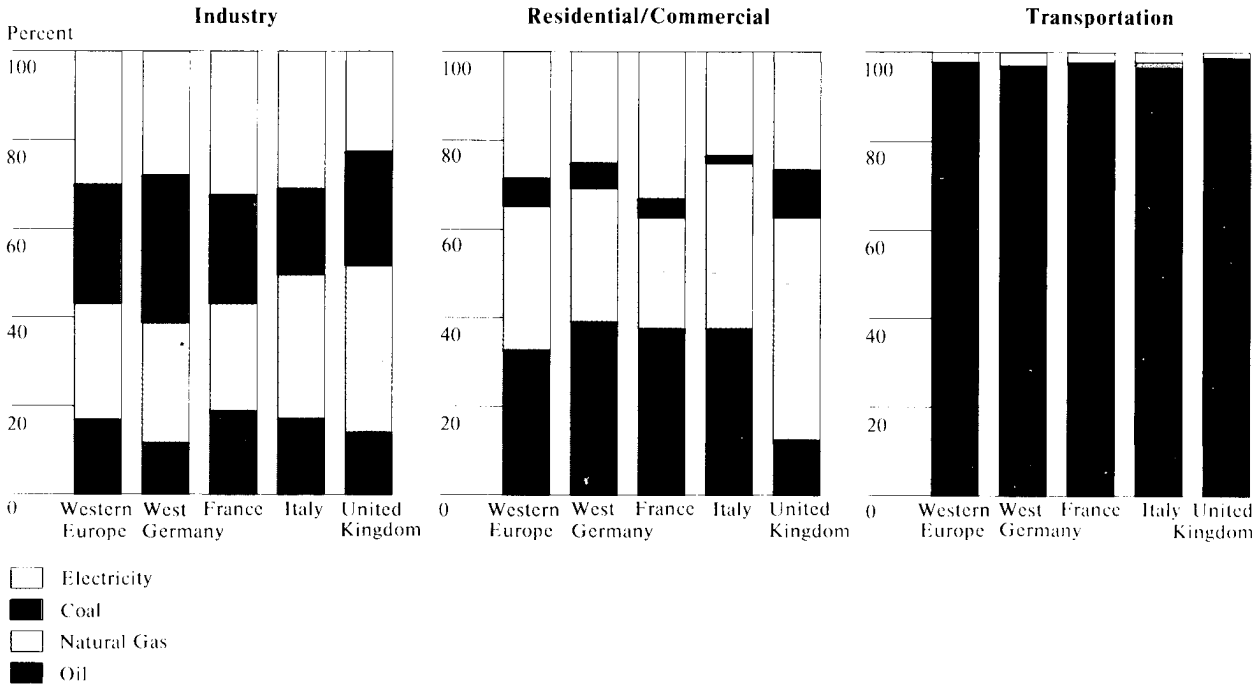

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Figure 9
Electricity Generation, 1990

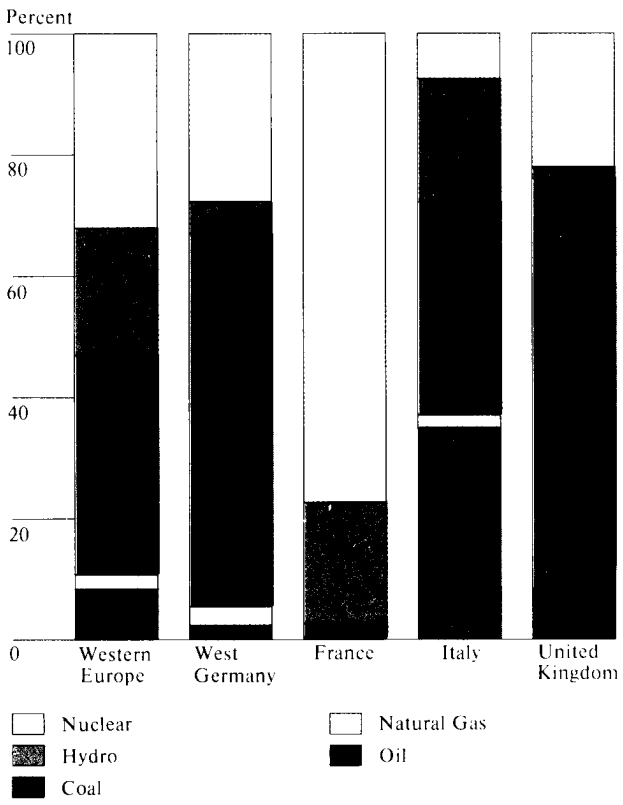

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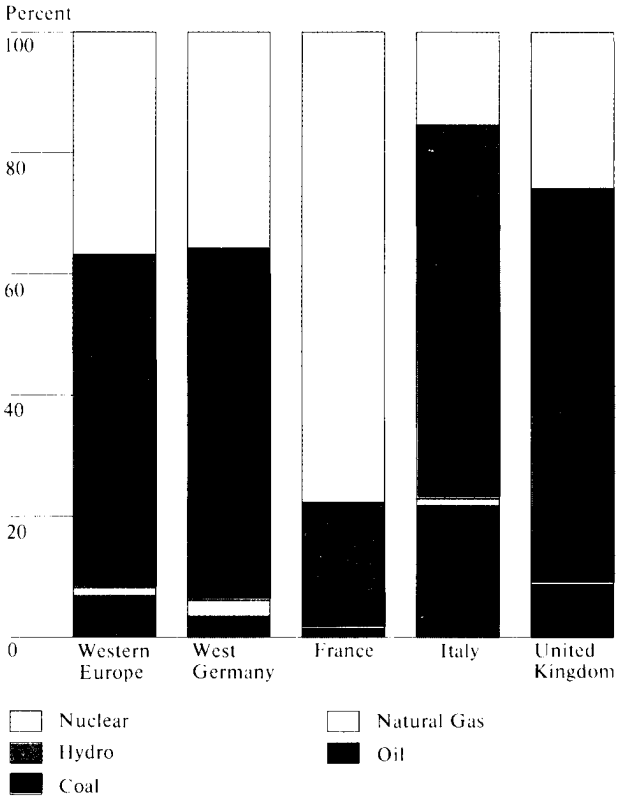
Figure 10
Electricity Generation, 2000



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Appendix

Energy Projections

Table A-1
Energy Projections: Western Europe, 1990 [a]

Million b/doe
(except where noted)

	DRI [b]	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range	OECD Requirements Study
Energy consumption	28.0	28.4	27.6	28.2	27.8	27.7	28.1		27.6 - 28.4	29.4
Energy production	16.0	15.9			16.8				15.9 - 16.8	16.9
Net energy import requirements	12.1	12.7			11.1				11.1 - 12.7	12.5
Oil consumption	12.5	10.7	11.8	12.6	11.2	11.7	12.8		10.7 - 12.8	11.2
Oil production	3.1	2.7	2.7	2.8	3.3				2.7 - 3.3	2.9
Net import requirements	9.4	8.0	9.1	9.8	7.9				7.9 - 9.8	8.3
Natural gas consumption	3.9	4.5	4.2	4.0	4.4	4.3	4.1	4.4	3.9 - 4.5	4.6
Natural gas production	2.9	3.1	3.3	3.2	2.9			3.0	2.9 - 3.3	3.2
Net import requirements	1.1	1.5	0.9	0.8	1.5			1.4	0.8 - 1.5	1.4
Coal consumption	6.2	7.8	6.3	6.2	6.2	6.4	6.0		6.0 - 7.8	7.3
Coal production	4.4	4.6			4.6				4.4 - 4.6	4.6
Net import requirements	1.8	3.2			1.6				1.6 - 3.2	2.7
Hydro	2.2	2.5	1.9	1.9	2.6	2.3	2.1		1.9 - 2.6	2.2
Nuclear	3.4	3.0	3.4	3.5	3.3	3.1	3.2		3.0 - 3.5	4.0
Fuel shares *(as percent of total energy)*										
Oil	44	38	43	45	40	42	46			38
Natural gas	14	16	15	14	16	16	14			16
Coal	22	27	23	22	22	23	21			25
Hydro	8	9	7	7	10	8	7			8
Nuclear	12	11	12	12	12	11	11			14

[a] Numbers may not add to totals shown due to rounding.
[b] Excludes Portugal, Iceland, Turkey, and Luxembourg. In 1980 total energy consumption and production amounted to about 0.9 and 0.4 million b/doe, respectively. Oil, coal, and hydro consumption amounted to 0.5, 0.3, and 0.1 million b/doe, respectively. Coal production equaled 0.3, million b/doe.

Table A-2
Energy Projections: Western Europe, 2000 [a]

Million b/doe
(except where noted)

	DRI [b]	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range	OECD Requirements Study
Energy consumption	34.2	31.5	30.8	33.2	32.1	31.1	33.0		30.8-34.2	35.3
Energy production	16.8	17.6			16.0				16.0-17.6	20.2
Net energy import requirements	17.4	13.9			16.0				13.9-17.4	15.0
Oil consumption	13.4	8.4	11.6	13.0	11.2	11.8	12.9		8.4-13.4	10.2
Oil production	2.4	2.4	2.7	2.5	2.9				2.4-2.9	2.9
Net import requirements	11.1	6.0	8.9	10.5	8.4				6.0-11.1	7.3
Natural gas consumption	4.9	4.7	4.6	5.1	5.0	4.6	5.1	5.0	4.6-5.1	5.6
Natural gas production	2.5	2.9	3.3	2.8	3.0			3.0	2.5-3.3	3.0
Net import requirements	2.5	1.8	1.3	2.3	2.0			2.0	1.3-2.5	2.6
Coal consumption	8.4	11.3	7.9	7.1	8.0	7.9	7.5		7.1-11.3	11.0
Coal production	4.4	5.2							4.4-5.2	5.8
Net import requirements	4.0	6.1							4.0-6.1	5.2
Hydro	2.5	3.0	2.4	2.3	3.1	2.5	2.3		2.5-3.0	3.4
Nuclear	5.1	4.0	4.3	5.7	4.8	4.2	5.2		4.0-5.7	5.1
Fuel shares (*as a percent of total energy*)										
Oil	39	27	38	39	35	38	39			29
Natural gas	14	15	15	15	16	15	15			16
Coal	24	36	26	21	25	25	23			31
Hydro	7	10	8	7	10	8	7			10
Nuclear	15	13	13	17	15	14	16			15

[a] Numbers may not add to totals shown due to rounding.
[b] Excludes Portugal, Iceland, Turkey, and Luxembourg. In 1980 total energy consumption and production amounted to about 0.9 and 0.4 million b/doe, respectively. Oil, coal, and hydro consumption amounted to 0.5, 0.3, and 1 million b/doe, respectively. Coal production equaled 0.3 million b/doe.

Table A-3
Energy Projections: West Germany, 1990 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range	IEA
Energy consumption	6.0	5.9	5.8			5.4			5.4-6.0	6.2
Energy production	2.8	2.9							2.8-2.9	3.0
Net import requirements	3.2	3.0							3.0-3.2	3.3
Oil consumption	2.6	2.0	2.2			2.2			2.0-2.6	2.5
Oil production	0.1	0.1							0.1	0.1
Net import requirements	2.5	1.9							1.9-2.5	2.4
Natural gas consumption	0.8	1.1	1.0			0.9		1.0	0.8-1.1	1.0
Natural gas production	0.2	0.3						0.3	0.2-0.3	0.3
Net import requirements	0.6	0.8						0.7	0.6-0.8	0.7
Coal consumption	1.9	2.1	2.0			1.7			1.7-2.1	1.9
Coal production	1.8	1.8							1.8	1.8
Net import requirements	0.1	0.3							0.1-0.3	0.1
Hydro	0.1	0.2	0.1			0.1			0.1-0.2	0.1
Nuclear	0.6	0.6	0.4			0.4			0.4-0.6	0.7

[a] Numbers may not add to totals shown due to rounding.

Table A-4
Energy Projections: West Germany, 2000 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range
Energy consumption	6.8			5.9		5.7			5.7-6.8
Energy production	2.8								
Net import requirements	3.9								
Oil consumption	2.7			1.9		2.0			1.9-2.7
Oil production	0.1								
Net import requirements	2.6								
Natural gas consumption	1.1			1.1		0.9			0.9-1.1
Natural gas production	0.1								
Net import requirements	1.0								
Coal consumption	2.0			2.0		2.0			2.0
Coal production	1.7								
Net import requirements	0.4								
Hydro	0.1			0.1		0.1			0.1
Nuclear	0.9			0.8		0.7			0.7-0.9

[a] Numbers may not add to totals shown due to rounding.

Table A-5
Energy Projections: France, 1990 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range	Government Plans—Revised Scenarios	
										I [b]	II [c]
Energy consumption	4.5	4.9	4.4			4.9			4.4-4.9	3.6-3.8	3.9-4.2
Energy production	2.0	2.2							2.0-2.2		
Net import requirements	2.5	2.7							2.5-2.7		
Oil consumption	2.0	1.7	1.8			2.2			1.7-2.2	1.2-1.3	1.3-1.4
Oil production	NEGL	NEGL									
Net import requirements	2.0	1.7							1.7-2.0		
Natural gas consumption	0.5	0.6	0.6			0.7			0.5-0.7	0.5-0.7	0.5-0.7
Natural gas production	0.1	0.1							0.1		
Net import requirements	0.4	0.6							0.4-0.6		
Coal consumption	0.3	0.8	0.5			0.7			0.3-0.8	0.3-0.6	0.5-0.7
Coal production	0.2	0.3							0.2-0.3		
Net import requirements	0.1	0.5							0.1-0.5		
Hydro	0.3	0.5	0.2			0.4			0.2-0.5	0.3	0.3
Nuclear	1.3	1.2	1.3			0.9			0.9-1.3	1.1-1.2	1.1-1.3

[a] Numbers may not add to totals shown due to rounding.
[b] 1.6-percent-growth case.
[c] 3.0-percent-growth case.

Table A-6
Energy Projections: France, 2000 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range
Energy consumption	5.5		4.8			5.6			4.8-5.6
Energy production	2.6								
Net import requirements	2.9								
Oil consumption	2.1		1.8			2.4			1.8-2.4
Oil production	NEGL								
Net import requirements	2.0								
Natural gas consumption	0.5		0.6			0.8			0.5-0.8
Natural gas production	NEGL								
Net import requirements	0.5								
Coal consumption	0.5		0.6			0.9			0.5-0.9
Coal production	0.1								
Net import requirements	0.3								
Hydro	0.4		0.3			0.4			0.3-0.4
Nuclear	2.0		1.5			1.1			1.1-2.0

[a] Numbers may not add to totals shown due to rounding.

Table A-7
Energy Projections: Italy, 1990 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range	IEA/SLT	Proposed Revision
Energy consumption	3.6	3.2	3.2			3.2			3.2-3.6	3.7	3.4
Energy production	0.6	0.6							0.6	0.7	
Net import requirements	3.1	2.7							2.7-3.1	3.1	
Oil consumption	2.0	1.5	1.8			1.6			1.5-2.0	1.9	1.8
Oil production	NEGL	NEGL							NEGL	0.1	
Net import requirements	2.0	1.5							1.5-2.0	1.8	
Natural gas consumption	0.6	0.6	0.6			0.7		0.7	0.6-0.7	0.7	0.6
Natural gas production	0.2	0.1						0.2	0.1-0.2	0.1	
Net import requirements	0.4	0.5						0.5	0.4-0.5	0.6	
Coal consumption	0.7	0.7	0.5			0.6			0.5-0.7	0.7	0.5
Coal production	NEGL	NEGL							NEGL	NEGL	
Net import requirements	0.7	0.7							0.7	0.6	
Hydro	0.2	0.3	0.3			0.2			0.2- 0.3	0.3	0.3
Nuclear	0.1	0.1	0.1			0.1			0.1	0.2	0.1

[a] Numbers may not add to totals shown due to rounding.

Table A-8
Energy Projections: Italy, 2000 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range
Energy consumption	5.1		4.9			3.7			3.7-5.1
Energy production	0.8								
Net import requirements	4.3								
Oil consumption	2.3		1.7			1.6			1.6-2.3
Oil production	NEGL								
Net import requirements	2.3								
Natural gas consumption	0.8		0.8			0.8			0.8
Natural gas production	0.1								
Net import requirements	0.7								
Coal consumption	1.4					0.8			0.8-1.4
Coal production	NEGL								
Net import requirements	1.4								
Hydro	0.3					0.2			0.2-0.3
Nuclear	0.3					0.3			0.3

[a] Numbers may not add to totals shown due to rounding.

Table A-9
Energy Projections: United Kingdom, 1990 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range	IEA
Energy consumption	4.4	4.4	4.0			4.3			4.0-4.4	4.3
Energy production	4.8	4.6							4.6-4.8	4.3
Net imports (exports)	(0.5)	(0.1)							(0.1)-(0.5)	NEGL
Oil consumption	1.6	1.4	1.4			1.5			1.4-1.6	1.7
Oil production	2.1	1.8	1.3						1.3-2.1	1.7
Net imports (exports)	(0.5)	(0.4)							(0.4)-(0.5)	NEGL
Natural gas consumption	0.9	1.0	0.9			1.0		0.9	0.9-1.0	0.8
Natural gas production	0.8	0.8	0.7					0.8	0.7-0.8	0.7
Net imports	0.1	0.2						0.2	0.1-0.2	0.1
Coal consumption	1.5	1.7	1.4			1.6			1.4-1.7	1.3
Coal production	1.5	1.7							1.5-1.7	1.4
Net imports (exports)	(0.1)	NEGL							(0.1)-NEGL	(0.1)
Hydro	NEGL	NEGL	NEGL			NEGL			NEGL	NEGL
Nuclear	0.4	0.3	0.3			0.3			0.3-0.4	0.4

[a] Numbers may not add to totals shown due to rounding.

Table A-10
Energy Projections: United Kingdom, 2000 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range
Energy consumption	5.0		4.3			4.3			4.3-5.0
Energy production	4.4								
Net imports	0.6								
Oil consumption	1.7		1.5			1.3			1.3-1.7
Oil production	1.5		1.7						1.5-1.7
Net imports	0.1								
Natural gas consumption	1.1		0.9			0.9			0.9-1.1
Natural gas production	0.8		0.8						0.8
Net imports	0.3								
Coal consumption	1.7		1.5			1.7			1.5-1.7
Coal production	1.6								
Net imports	0.1								
Hydro	NEGL		NEGL			0.1			NEGL-0.1
Nuclear	0.5		0.4			0.3			0.3-0.5

[a] Numbers may not add to totals shown due to rounding.

Table A-11
Energy Projections: Norway, 1990 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range	IEA
Energy consumption	0.6					0.6			0.6	0.5
Energy production	1.6									1.6
Net imports (exports)	(1.0)									(1.1)
Oil consumption	0.2					0.2			0.2	0.2
Oil production	0.6		0.9						0.6-0.9	0.7
Net imports (exports)	(0.4)									(0.5)
Natural gas consumption	0.1	NEGL				0			0.1	0
Natural gas production	0.6	0.6	0.5					0.5	0.5-0.6	0.6
Net imports (exports)	(0.6)	(0.6)							(0.6)	(0.6)
Coal consumption	NEGL					NEGL			NEGL	NEGL
Coal production	NEGL									NEGL
Net imports	NEGL									NEGL
Hydro	0.3					0.4			0.3-0.4	0.3
Nuclear	0					0				0

[a] Numbers may not add to totals shown due to rounding.

Table A-12
Energy Projections: Norway, 2000 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range
Energy consumption	0.8					0.7			0.7-0.8
Energy production	1.7								
Net imports (exports)	(0.9)								
Oil consumption	0.2					0.2			0.2
Oil production	0.5		0.8						0.5 0.8
Net imports (exports)	(0.3)								
Natural gas consumption	NEGL					0			0-NEGL
Natural gas production	0.7		0.9						0.7-0.9
Net imports (exports)	(0.6)								
Coal consumption	NEGL					NEGL			NEGL
Coal production	NEGL								
Net import requirements	NEGL								
Hydro	0.5					0.5			0.5
Nuclear	0					0			

[a] Numbers may not add to totals shown due to rounding.

Table A-13
Energy Projections: Netherlands, 1990 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range	IEA
Energy consumption	1.5	1.6				1.5			1.5-1.6	1.7
Energy production	0.9	1.1							0.9-1.1	1.0
Net imports	0.6	0.6							0.6	0.7
Oil consumption	0.8	0.7				0.7			0.7-0.8	0.8
Oil production	0.1	NEGL							NEGL-0.1	NEGL
Net imports	0.7	0.6							0.6-0.7	0.8
Natural gas consumption	0.6	0.6				0.5		0.6	0.5-0.6	0.6
Natural gas production	0.8	1.0		1.2				1.0	0.8-1.2	0.9
Net imports (exports)	(0.2)	(0.4)						(0.5)	(0.2)-(0.5)	(0.3)
Coal consumption	0.2	0.3				0.2			0.2-0.3	0.2
Coal production	0	0								
Net imports	0.2	0.3							0.2-0.3	0.2
Hydro	0					0				0
Nuclear	NEGL	NEGL				NEGL			NEGL	NEGL

[a] Numbers may not add to totals shown due to rounding.

Table A-14
Energy Projections: Netherlands, 2000 [a]

Million b/doe

	DRI	Firm A	Firm B	Firm C	Firm D	Firm E	Firm F	Firm G	Range
Energy consumption	1.9					1.6			1.6-1.9
Energy production	0.7								
Net import requirements	1.3								
Oil consumption	0.9					0.8			0.8-0.9
Oil production	NEGL								
Net import requirements	0.9								
Natural gas consumption	0.6					0.5			0.5-0.6
Natural gas production	0.5			0.8					0.5-0.8
Net import requirements	0.1								
Coal consumption	0.3					0.2			0.2-0.3
Coal production	0								
Net import requirements	0.3								
Hydro	0					0			
Nuclear	0.1					NEGL			NEGL-0.1

[a] Numbers may not add to totals shown due to rounding.

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